




BMP #45 - Wet Pond (Conventional Pollutants)

Targeted Pollutants	
80% Sediment	
45% Phosphorus	
 Trace metals	
 Bacteria	
 Petroleum hydrocarbons	

Physical Limits	
Drainage area	<u>15-20 ac</u>
Max slope	<u>10%</u>
Min bedrock depth	<u>3</u>
Min water table	<u>2</u>
SCS soil type	<u>CD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>yes</u>

DESCRIPTION

This BMP is designed to provide runoff treatment for conventional pollutants but not nutrients. A wet pond is an open pond with the outlet set higher than the bottom of the facility. This usually results in a permanent pool of water that serves as "dead storage" and is very effective at removing pollutants. In an arid environment, the pool of water may evaporate in between storms, but the pollutants are still trapped. As an option, a shallow marsh area can be created within the permanent pool volume to provide additional treatment (see BMP #46-Wet Pond for Nutrient Control).

APPLICATION AND LIMITATIONS

If well-planned, wet ponds can meet a variety of objectives. These may include protection of infrastructure and property, improving water quality, enhancing wildlife habitats, and providing recreational opportunities.

In order to serve as a multi-purpose facility the wet pond should function in such a manner as to be compatible with overall stormwater systems both upstream and downstream. This provides a watershed approach to stormwater management as well as local flood control.

If the facility is planned as an artificial lake to enhance property values and promote the aesthetic value of the land, pretreatment in the form of landscape retention areas or perimeter swales should be

incorporated into the stormwater management facility. If possible, catchbasins should be located in grassed areas. By incorporating this "treatment train" concept into the overall collection and conveyance system, the engineer can prolong the utility of these permanently wet installations and improve their appearance. Any amount of runoff waters, regardless how small, that is filtered or percolated along its way to the final detention area can remove oil and grease, metals, and sediment. In addition, this will reduce the annual nutrient load to prevent the wet pond from becoming eutrophic with excessive algal blooms, low oxygen levels, and odor.

Detention system site selection should consider both the natural topography of the area and property boundaries. Aesthetic and water quality considerations may also dictate locations. The permanent pool of the wet pond is an integral part of the environment and therefore should serve as an aesthetic improvement to the area if possible. Use of good landscaping principles is encouraged. The planting and preservation of desirable trees and other vegetation should be an integral part of the storage facility design.

In planning new detention facilities, it should be kept in mind that the goal of improved water quality downstream may conflict with certain desired uses of the facility. It is only logical that if the basin is used to remove pollutants, the water quality within the basin itself will be lowered, thus reducing the applicability for uses such as water supply, recreation, and aesthetics. In planning the facility the engineer or planner should have a good knowledge of site-specific runoff constituents and an understanding of the possible effects on the quality of the stored water.

The design of urban detention facilities should be coordinated with a basin plan for managing stormwater runoff. In a localized situation, an individual property owner can, of course, by his or her actions alone, provide effective assistance to the next owner downstream if no other areas contribute to that owner's problems. However, uncontrolled proliferation of impoundments within a watershed can severely alter natural flow conditions, causing compounded flow peaks or increased flow duration which can contribute to downstream degradation. In addition, upstream impacts due to future land use changes should be considered when designing the structure. Land use planning and regulation may be necessary to preserve the intended function of the impoundment.

DESIGN PARAMETERS

Site Constraints

All facilities should be a minimum of 20 feet from any structure, property line, and any vegetative buffer required by the local or state government, 100 feet from any septic tank/drainfield (except wet vaults should be a minimum of 20 feet), and 100 feet from any wells or water supplies.

All facilities should be a minimum of 50 feet from any steep (greater than 15%) slope. A geotechnical report must address the potential impact of a wet pond on a steep slope.

Permanent Pool Volume

The permanent pool volume should be equal to the runoff volume of 1/3 of the 2-year, 24-hour design storm. Review Appendix G-2 for additional information on sizing the detention facility.

Overflows

Detention facility design must take into consideration the possibility of overflows. An overflow device must be installed in all facilities to bypass flows over or around the restrictor system. The most common overflow event is snowmelt, but overflows may also result from higher intensity or longer duration storms than the design storm or result from plugged orifices or inadequate storage due to sediment buildup in the facility.

Pond Configuration And Geometry

Wet ponds may be single-celled or multi-celled. The multi-celled version requires more planning and maintenance due to the extra berms involved, however, some studies have shown it to be more effective at pollutant removal. Regardless of the configuration, the total pond area and volume should be consistent with the sizing criteria given in Appendix G-2.

Long, narrow ponds are preferred, as these are less prone to short-circuiting and tend to maximize available treatment area. The length-to-width ratio should be at least 3:1 and preferably 5:1. The inlet and outlet should be at opposite ends of the pond where feasible. If this is not possible, then berms can be installed to increase the flow path and water residence time. Slightly irregular ponds may perform more effectively and will have a more natural appearance.

Interior side slopes up to the maximum water surface should be no steeper than 3H:1V. Exterior side slopes should be no steeper than 2H:1V.

The pond bottom should be level to facilitate sedimentation.

Liner To Prevent Infiltration

Detention BMPs should have a negligible infiltration rate through the bottom of the pond. Infiltration will impair the proper functioning of detention BMPs and can contaminate groundwater.

Berm Embankment/Slope Stabilization

Pond embankments higher than 6 feet should require design by a geotechnical-civil engineer licensed in the state of Idaho. For berm embankments of 6 feet or less (including 1 foot freeboard), the minimum top width should be 6 feet or as recommended by the geotechnical-civil engineer.

Pond berm embankments must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a geotechnical report) free of loose surface soil materials, roots and other organic debris.

Exposed earth on the side slopes should be sodded or seeded with the appropriate seed mixture as soon as is practicable (see BMP #35-Seeding and #36-Sodding). If necessary, geotextile or matting (BMP #13 and #14) may be used to stabilize slopes while seeding and sodding become established.

Gravity Drain

A gravity drain for maintenance should provide an outlet invert of one foot above the bottom of the facility and should be sized to drain the facility in four hours or less.

CONSTRUCTION GUIDELINES

Widely acceptable construction standards and specifications such as those developed by the USDA - Soil Conservation Service (SCS) or the U.S. Army Corp of Engineers for embankment ponds and reservoirs may aid in building the impoundment. Additional information is also available from the Idaho Transportation Department's Design manual. It is important that appropriate erosion control techniques be used during construction of a wet pond.

MAINTENANCE

Failure of large impoundment structures can cause significant property damage and even loss of life. Such structures should be designed only by professional engineers registered in the state of Idaho who are qualified and experienced in impoundment design. Where they exist, local safety standards for impoundment design should be followed. Impoundment structures should also be regularly inspected for signs of failure, such as seepage or cracks in the berm.

The presence of wet ponds and marshes in established urban areas is perceived by many people to be undesirable. They are often thought of as mud holes where mosquitoes and other insects breed. If the wet pond has a shallow marsh established, the pond can become a welcomed addition to a residential community. Constructed fresh water marshes can provide miniature wildlife refuges, and while insect populations are increased, insect predators also increase, often reducing the problem to a tolerable level. Nevertheless, local government and homeowners associations may wish to drain the ponds during late spring and summer if there is sufficient concern. However, it is imperative that the vegetation in shallow marsh areas not die off during draindown periods, otherwise the pollutant removal effectiveness of the wet pond can be severely impacted. In addition, the decaying vegetation can create nuisance conditions.

Periodic mowing will keep weeds and grass under control and usually helps with neighborhood acceptance. Trash and debris removal should also be done regularly to avoid the facility becoming a convenient dumping ground for trash, construction debris, and yard waste.

Safety, Signage And Fencing

Ponds which are readily accessible to populated areas should incorporate all possible safety precautions. Steep side slopes (steeper than 3H:1V) at the perimeter should be avoided and dangerous outlet facilities should be protected by enclosure. Warning signs for deep water and potential health risks should be used wherever appropriate. Signs should be placed so that at least one is clearly visible and legible from all adjacent streets, sidewalks or paths. A notice should be posted warning residents of potential waterborne disease that may be associated with swimming or fishing in these facilities.

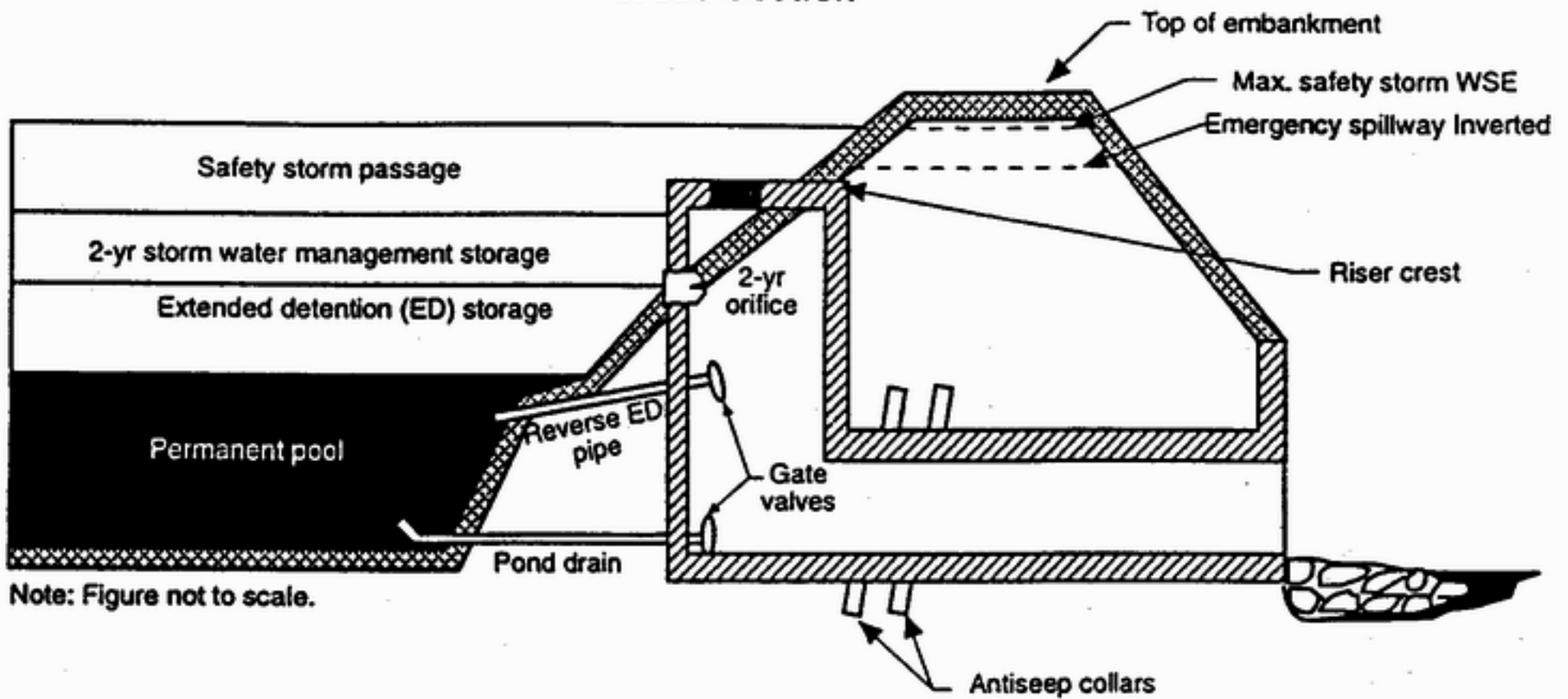
If the pond surface exceeds 20,000 sq. feet, include a safety bench around the basin with a width of 5 feet, and with a depth not exceeding one foot during non-storm periods. Emergent vegetation such as cattails should be placed on the bench to inhibit entry by unauthorized persons.

A fence is required at the maximum water surface elevation, or higher, when a pond slope is a wall. Local governments and homeowners associations may also require appropriate fencing as an additional safety requirement in any event. Native shrubs with thorns may provide a low-cost alternative to fencing, that also enhances natural habitat.

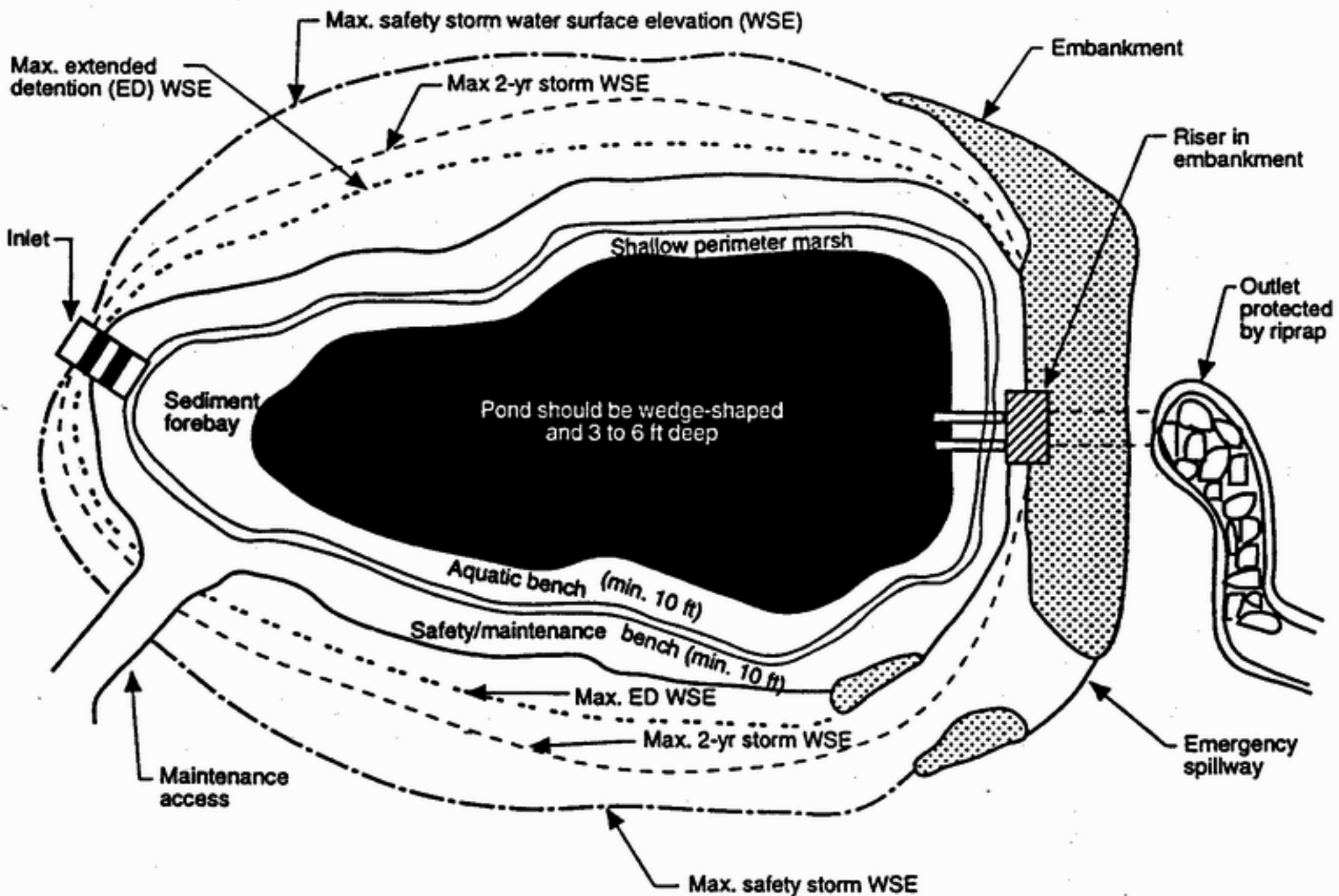
Heavy Metal Contamination

Studies have shown high accumulation rates of lead, zinc, and copper on and near heavily traveled highways and streets. Runoff from highways and streets can be expected to carry significant concentrations of these heavy metals. If a significant portion of the drainage area into a pond consists of highways, streets, or parking areas or other known sources of heavy metal contamination, there is a potential environmental health hazard. In such cases the multiple use functions of the pond should be limited and accessibility should be restricted. Additionally, liners may be required in order to prevent these types of pollutants from migrating into the underlying soil or groundwater system.

Cross Section



Plan View



Comparative Capability of 10 Pond/Wetland Alternatives—Physical, Environmental, and Maintenance Constraints

Pond/Wetland Alternative	Minimum Drainage Area ^a	Space Index ^b	Water Balance	Clogging Risk	Sediment Cleanout	Waters of U.S. (404)	Stream Warming	Safety Risk
1. Conventional dry ponds	5	0.5	No restrictions	Moderate	Basin (10-20 yr)	?	Low	Low
2. Dry ED ponds	10	1.0	No restrictions	High	Basin (10-20 yr)	Yes	Moderate	Low
3. Micropool dry ED ponds	15	1.0	May require base flow	Low	Forebay (2-5 yr)	Yes	Moderate	Low
4. Wet ponds	25+	1.0	Climate	Low	Forebay (2-5 yr)	Yes	High	High
5. Wet ED ponds	25+	1.0	Climate	Low	Forebay (2-5 yr)	Yes	High	High
6. Shallow marsh systems	25+	2.5	Climate, base flow	Low	Forebay (2-5 yr)	Yes	High	Moderate
7. ED wetlands	10+	1.5	Climate, base flow	Low	Forebay (2-5 yr)	?	High	Moderate
8. Pocket wetlands	1-5	2.0	Climate, ground water	Moderate	Basin (5-10 yr)	No	Moderate	Moderate
9. Pocket ponds	1-5	1.0	Climate, ground water	Moderate	Basin (5-10 yr)	No	Moderate	Moderate
10. Pond/marsh systems	25+	1.5	Climate, base flow	Low	Pool (10-15 yr)	Yes	High	High

^aMaximum of 400 acres in most cases.

^bSpace consumption index (1 = space required for wet pond).